WATER SUPPLY ISSUES WORKSHOP SUMMARY

INTRODUCTION

On February 8, 2001 the Siting and Environmental Protection Committee of the California Energy Commission (Energy Commission) conducted a workshop on water issues that may constrain the licensing of future power plants in California and to discuss strategies to address these issues. The three topics discussed at the workshop included: (1) water supply and water regulations, (2) technological solutions, and (3) water policy issues.

OVERVIEW OF ORAL PRESENTATIONS

OVERVIEW OF WATER SUPPLY ISSUES

Mr. Joe O'Hagan, representing the Energy Commission staff, provided a brief overview of water issues addressed in siting cases. Although on a statewide basis power plants are not major consumers of water as compared to agricultural and urban uses, powerplant consumption of water on a local level is often large compared to other uses. Therefore, water supply issues are often of concern to the public.

Mr. O'Hagan stated that most proposals for power plant water supply have been workable. However, a lack of information about project impacts on water supply in the early stages of the staff assessment process has often led to delays in completing the siting process.

PANEL 1: WATER SUPPLY AND WATER REGULATIONS

Mr. Ed Anton, Acting Executive Director SWRCB

Mr. Ed Anton stated that the State Water Resources Control Board (SWRCB or State Board) and Regional Water Quality Control Boards (Regional Boards) regulate two aspects of water within California. The first is water supply that is regulated by the State Water Resources Control Board-primarily for power plants through the Policy on Inland Sources of Cooling Water. Water quality is regulated primarily through the Regional Boards through the issuance of discharge permits.

Mr. Anton explained that the State Water Resources Control Board's Policy on Inland Sources of Cooling Water (Order 75-58) sets up a priority of water sources that should be used for cooling, such as wastewater that would otherwise be discharged to the ocean. This policy, however, consistent with the Energy Commission approach to the policy is that it "…was not set up as an absolute…(page 6, lines 22-23)." The policy does call for the consideration of alternative cooling water sources. Also addressed by the policy is the discharge of wastewater. Since the use of evaporative cooling in a power plant concentrates the salts, the policy calls for wastewater to be discharged to salt sinks or lined ponds.

Mr. Anton also explained that there are both federal and state regulations addressing water quality protection. The State Board has adopted a statewide water quality control plan for the discharge of thermal waste to coastal, interstate, and estuarine waters. There are also standards for thermal waste discharge to inland waters contained in water quality control plans adopted by the Regional Boards, subject to the approval of the State Board.

Federal law and regulation also provide rules and water quality standards for various types of discharges for various types of pollutants. These rules and standards are delegated to and administered by the nine Regional Water Quality Control Boards within the state through the National Pollutant Discharge Elimination System (NPDES) permit program. These permits are required for all point source discharges of waste to navigable waters.

The Federal Clean Water Act includes a provision [Section 316(a)] that states that thermal standards can be waived as long as it is shown that a balanced indigenous populations of fish, shellfish, and wildlife can be supported in the water body where the discharge occurs. This provision is incorporated into the state thermal plan as an exception process. However, completing the studies necessary to support that showing takes a fair amount of time. Many power plants are currently operating under such exceptions, but it is not certain how or whether such exceptions can be applied to new or modified discharges needed for powerplant repowerings, refurbishments or modernizations.

Section 316(b) basically calls for the best cooling water intake technology. Since there are no regulations that specify how this is determined, the Regional Boards have dealt with it on a case-by-case basis. The USEPA has proposed regulations for new units or intake structures that are fairly restrictive and would prohibit the use of once-through cooling in all circumstances except where the cooling water was drawn from the open ocean. The regulations are in abeyance pending review by the Bush administration.

Commissioner Laurie asked whether the use of once-through cooling for gas-fired plants is prevalent in older coastal powerplant facilities and coastal repowering or modernization proposals. Mr. Anton stated that once through cooling is prevalent for both existing and repowering or modernized coastal powerplants. However, new inland facilities typically have employed wet cooling tower technologies. The discussion then turned to PG&E's Diablo Canyon and SCE's San Onofre facilities. These facilities both use once-through cooling, but the Diablo Canyon facility's intakes and discharges are located near-shore, while the San Onofre facility's intake and discharge structures are offshore. The impacts of these two facilities are different, and the near-shore intakes and discharges would not be allowed by current regulations.

Commissioner Pernell inquired about water supply sources for inland plants, and Mr. Anton described possible sources for the typical wet-cooling technology, including obtaining new water rights (a long, difficult process, because most are already established) and purchasing water from an entity with existing rights (e.g., an irrigation district).

Commissioner Pernell then inquired about cooling tower blow-down (wastewater) disposal. Mr. Anton and Mr. O'Hagan described various options including discharge to lined evaporation ponds, the local sewer system, into the groundwater through injection wells, and zero discharge facilities where the water is recycled.

Craig Wilson, Chief Counsel, SWRCB

Mr. Craig Wilson described the memorandum of understanding that was entered into between the Energy Commission staff and the Board in 1998 to coordinate the agencies activities with respect to siting issues related to both water supply and water quality. Commissioner Laurie indicated his appreciation for the cooperation with other State agencies. Mr. Wilson then described the two State Broad general policies that where adopted in the early 1970s: the thermal plan that addresses water quality issues, and the cooling policy that addresses supply issues.

Mr. Wilson described how in the Three Mountain AFC proceeding, the cooling policy encouraged the interested parties to negotiate, which resulted in the applicant modifying the project to include a hybrid wet/dry cooling system that reduced consumption of fresh groundwater. Mr. Wilson then addressed the proposed USEPA Section 316(b) regulations discussed previously and the thermal plan. He confirmed that the Bush Administration has held up these regulations by Executive Order. He indicated that on re-powering projects the key issue with respect to the thermal plan and Section 316(a) compliance is the determination of whether the discharges are existing or new – this is being evaluated on a case-by-case basis.

Mr. Anton and Commissioner Laurie further discussed agency cooperation, and then Mr. Anton, Commissioner Laurie, and Mr. O'Hagan discussed groundwater and information availability for adequacy of impact assessment. It was recognized that while most groundwater basins have been reasonably well defined, the behavior of and interaction among local aquifers is sometimes very difficult to assess and predict.

Mr. Kamyar Guivetchi, Statewide Planning Branch, DWR

Mr. Kamyar Guivetchi started by stating that the State Department of Water Resources (DWR) is in the process of updating Bulletin 118 (California's Groundwater), last updated in 1980, with a draft due in the Fall and publication of the final report in 2002. This bulletin will have comprehensive, up-to-date information on the state's groundwater basins. Commissioner Laurie indicated his concern regarding groundwater law and its fluidity. Mr.Douglas Osugi, DWR's Program Manager for the Bulletin 118 update, was introduced. Mr. Osugi described the update process and made the distinction between adjudicated basins (in which the available water is allocated by agreements or the courts and is supervised by a watermaster) and non-adjudicated basins, where it is basically "first come first served", with the local planning agencies responsible for determining adequacy of supplies. The problem in these situations is the lack of information on the safe yield of these basins. So power plant applicants may need to work with local planning agencies to assess yields and impacts and to protect recharge areas and prevent contamination of resources. Mr. Guivetchi added that the surface owner generally has rights to groundwater below, but that groundwater users and the legislature are recognizing the importance of basin planning and management.

Mr. Guivetchi then proceeded with a slide presentation, the data in which are largely based on the DWR's 1998 State Water Plan (the state's water master plan that is updated every five years and for which an EIR is not prepared). He focused on existing supplies and uses – a water budget with existing facilities and projects and forecasts through Year 2020. A pie chart was then presented, showing that a total of 200 million acre-feet of water are potentially available in a year of average precipitation. Surface runoff accounts for 71,000 acre-feet of this. The developed water supply is 57,000 acre-feet (of which some is groundwater).

The 71,000 acre-feet of runoff is distributed differently throughout the state's ten regions, with, in general, much more in the north. And the precipitation and runoff for any given year can vary dramatically from the average. It is important to note that water supplies are moved from region to region within the state; there are regulatory and environmental conditions as well as other constraints that result in water movements less than the capacities of the inter-regional conveyance facilities.

Commissioner Laurie asked about the feasibility of developing those supplies that are still undeveloped. Mr. Guivetchi replied that DWR has looked at additional development and conservation to provide about two million more acre-feet; the smaller streams have not been looked at for additional supplies. There are a lot of interests and concerns about adversely affecting the environment in doing so.

Next, Mr. Guivetchi presented a breakdown of all supplies (78 million acre-feet per year on average) and who is controlling them. The Federal and State surface water projects only account for 30% of the developed surface water resources. A lot of the water is controlled at the local level. About 12.5 million acre-feet come from groundwater and about 300,000 acre-feet come from recycled and desalted water.

Agricultural and environmental uses account for about 45% each and urban uses accounts for 11%. In answer to a question from Commissioner Laurie, Mr. Guivetchi explained that environmental uses (of developed supplies) include water reserved for wild and scenic rivers, in-stream uses, and wildlife refuges. Projecting to 2020, the numbers don't change appreciably, but there's a slight shift predicted from agricultural to urban uses (with environmental uses assumed not to change).

DWR estimates for 1995 base conditions in an average hydrologic water year show a shortage between uses and supplies of about 1.6 million acre-feet, provided by groundwater overdraft. By 2020, because there will be more uses and about the same supply, the shortage or shortfall would be about 2.4 million acre-feet. These shortages are distributed differently around the state.

In the 2020 projections, DWR estimates that there will be a significant increase in recycled and desalted (coastal) water available. Because of the ability of power plants to use these waters, there might be an opportunity to use these waters as the State Board policy suggests rather than using fresh water for powerplant cooling.

Commissioner Laurie noted that the use of recycled water or desalted water suggests new power plant uses in heavily urbanized and coastal areas, where there are other barriers to siting. He believes there will be increasing pressures to locate plants

outside of these urban and coastal areas where such resources are not going to be available. So there are going to be conflicts. Mr. Guivetchi noted that agricultural drain water might be more available in the future.

Mr. Guivetchi then showed how additional supplies and conservation can bring the shortfall for 2020 down to about 200,000 acre-feet in an average year, but that in dry years significant shortfalls, particularly in some regions, may still occur. Commissioner Laurie asked about regulatory protection of environmental uses and it was stated that both Federal and State protections are in place, and that in emergencies there is some potential for relaxation of these protections, generally on a case-by-case basis.

Mr. Guivetchi then addressed cost. Groundwater pumping costs range from $10 per acre-foot to about $50 per acre-foot in the north to as high as $130 per acre-foot in the San Francisco Bay region and elsewhere. There is an increasing trend for groundwater basin users to work together to have management plans. AB-3030 has resulted in the establishment of about 150 of those, and about 17 counties have already enacted groundwater management ordinances since 1994. Therefore, in the siting of power plants, it would be very good to work closely with the local entities, especially if they have groundwater management plans and ordinances. In response to Commissioner Pernell, it was noted that many such ordinances deal with export of groundwater and associated impacts. In adjudicated basins (where a court has stepped in and worked with the locals on how the waters would be used and distributed), it would be a more difficult, formal process to gain groundwater supplies.

In his conclusion, Mr. Guivetchi supported State Board Resolution 75-58 in its emphasis on water conservation and use of fresh waters to the least extent possible. DWR needs to work very closely with Commission staff to insure that the next Water Plan update takes into consideration these options and opportunities. Power plant siting should consider and coordinate with CalFed project planning and implementation. Again, coordination with local planning agencies with respect to groundwater supply was stressed. Finally, Mr. Guivetchi summarized the State water planning process, opportunities for input, and the detailed data from 275 analysis units that will be developed and may be useful for siting.

Commissioner Laurie asked about data needs and availability for determining impacts on water supplies; various sources were discussed, including CalFed and local agencies, but project proponent flexibility (e.g., use of combined wet/dry cooling technology) was also recommended. Mr. O'Hagan mentioned that such sources as General Plans and associated EIRs, and water district plans and EIRs can provide some useful information. But in general, these studies are not readily usable in assessing local water (e.g., groundwater drawdown) impacts of power projects. Bill Chamberlain stressed that tradeoffs in energy and water costs can be very important, and that use of water for cooling can be a high-value use, as shown in the High Desert project.

Mr. O'Hagan mentioned that some of the county ordinances encountered on siting cases were not constraints on groundwater pumping, but rather a way of monitoring well drilling and pumping.

Mr. Wayne Hoffman, Regional Environmental Manager, Duke Energy North America

Mr. Wayne Hoffman stated that about 40 percent of the state's generation now employs once-through cooling and most of those plants, about 20,000 megawatts, are located on the coast. About five or six new or modified powerplants, 5000 or 6000 megawatts, are now being proposed. The Moss Landing project is currently under construction, and will use once through cooling. He indicated that the repowering or expansion of capacity at the existing facilities could provide for a substantial amount of generation to meet future demand in California. He stated that once-through cooling is highly efficient, citing a Duke Energy analysis that showed a loss of almost 100 megawatts on a 1,000-megawatt project in going from a once-through cooling system to a dry cooling system. In response to a question from Commissioner Pernell, Mr. Hoffman indicated that the desirability of siting a power plant in a depleted water basin is low, ostensibly because of such a loss in efficiency.

He then indicated that the Coastal Act provides preference and priority for coastal-dependent uses within the coastal zone. He also indicated that State Water Resources Control Board policy gives the second highest priority (after wastewater which is discharged to the ocean) to ocean water for power plant cooling.

Mr. Hoffman then proceeded to describe how these modernized or re-powered plants offer a lot of benefits, largely due to improved efficiencies, most of which Duke Energy presented in the case of its Moss Landing project, including:

- Reduced use of seawater and lower discharge temperature
- Reduced air emissions
- Reduced natural gas consumption
- Reduced noise
- Reduced impingement and entrainment impacts
- Smaller profile (touting the Morro Bay project currently before the Commission)
- Improved coastal access.

Mr. Hoffman regarded the reuse of existing sites and replacing existing plants as a major positive environmental benefit. He believes that avoiding the use of cooling towers on the coast is very important from a visual standpoint because of their size and unsightliness, as well as their noise levels.

With respect to Clean Water Act Sections 316(a) and 316(b), Mr. Hoffman made the following points:

- Many of these existing plants have substantial data regarding their intake and discharge impacts
- Thermal impacts can be easily modeled and future impacts assessed based on past impacts

- The existing discharge and intake systems can be used without major modification, and thereby qualify for treatment under the regulations as an existing facility (e.g., under the balanced indigenous community requirements discussed previously).

Commissioner Laurie asked about the definition of the term “repower”. Mr. Hoffman stated that it is generally used for plant modernization and is not a specifically defined term. He confirmed that he even uses the “repower” term for the Morro Bay project where the entire power plant would be replaced, because the intake and discharge structures would be retained.

Mr. Hoffman went on to explain that new ocean discharges must meet a 20-degree temperature differential (between intake and receiving waters) and a four degree differential between discharge and receiving water at 1000 feet. He believes that the repowered plants can and should be regulated as existing facilities.

Commissioner Laurie then asked if, from a developer's perspective, the federal requirements, as set forth in Sections 316(a) and 316(b), with proper engineering, can be met, and Mr. Hoffman stated that they could.

Commissioner Pernell asked about the permitting role of the Coastal Commission and how the Section 316(a) and (b) requirements are administered, and the roles of the Coastal Commission and the State and Regional Water Boards were discussed, particularly the Federally-delegated authorities of the Water Boards.

Mr. Hoffman then proceeded through some cooling technology comparison slides (impacts, costs, efficiencies) – for a 1,000 megawatt plant, losses of 48, 50, and up to 100 megawatts for natural draft, mechanical draft, and dry cooling technologies were claimed. Commissioner Laurie questioned whether efficiency isn’t just one of various factors that need to be considered (in addition to appearance, water supply, etc.). With respect to operating costs for a 1,000 megawatt plant over 30 years, Mr. Hoffman asserted that wet cooling towers would add $130 million with gas at $3.50/mmBtu and $200 million with gas at $5/mmBtu, and that dry cooling towers would add $500 million at $5/mmBtu and $1.5 billion at today’s prices. He agreed to provide estimates of added costs for consumers at the request of Commissioner Laurie.

Mr. Hoffman closed with a recommendation that when a replacement plant or modernization lowers the water use and reduces biological effects from an existing baseline plan, the project be allowed to move forward without mitigation requirements. For inland projects he recommended greater cooperation with agricultural users and application of zero discharge technologies. Commissioner Laurie pointed out that adjudicated basins have established rules and that attaining water rights elsewhere may be problematic and Mr. Hoffman indicted that a variety of means are available to get water rights, including land purchase and creatively working with the agricultural community.

PANEL 2: TECHNOLOGICAL SOLUTIONS

DR. John Maulbetsch, Consultant to the Energy Commission on the PIER Program

Dr. John Maulbetsch stated that his presentation on cooling technologies would focus on a 500 megawatt gas fired combined cycle plant (170 megawatts from the steam turbine) as opposed to the Duke Energy analysis of 1,000 megawatts steam turbine powerplant.

To condense the steam in Dr. Maulbetsch's model plant, 3,000 acre-feet per year would be needed with wet cooling tower technology, the greatest water consumer in the plant (95%). The technology is called recirculating wet cooling, employing fans, and losing about 2 to 3% of the water to evaporation per cycle through the cooling system. About 10 gallons per minute (gpm) are evaporated; 2 gpm are lost as blowdown. Impacts from this type of cooling technology are related to discharge of the blowdown wastewater, drift deposition, plume visibility, and noise.

Dr. Maulbetsch explained that with dry cooling, steam is ducted to an air-cooled condenser, which is like an auto radiator. There would only be the 5% percent hotel and auxiliary load to consume water, with no blowdown, no drift, and no plume. It can be noisier than a wet cooling tower because a lot more air is circulated. The capital costs of an optimized dry cooling system should be between 1.5 and 2.5 times as much as an optimized wet cooling tower system, based on about ten different studies that have been conducted over the years. Costs were about $17 million for the model plant at a temperature difference of 55 degrees between condensing temperature and ambient temperature. Costs are higher with higher ambient temperatures, and lower with lower ambient temperatures, and they are more variable with dry-cooling systems versus wet-cooling systems. Key capital cost factors include higher materials costs, higher fan costs, and higher costs for more elaborate steam ducting.

In addition, as ambient temperate rises, back pressure goes up and efficiency goes down – it could be as much as a 10% loss (of the 170 steam turbine megawatts in the model 500-megawatt combined cycle plant) – during (seasonal) periods of high temperature.

Dr. Maulbetsch then described three kinds of hybrid wet-dry cooling systems. First was the single tower design in which there is a wet tower on the bottom and a dry tower on the top. Louvers are used to direct the air between the upper and lower sections, as appropriate. Second was the split steam design where there are two parallel cooling systems - a wet cooling tower on one side of the plant, with its condenser, and a dry cooling tower on the other side of the plant. Third was what's often called a swamp cooler, where the inlet air to the dry tower is pre-cooled with something that looks like a conventional wet tower. He also showed an example of high-pressure water spray nozzles, which can make a mist and cool the inlet air, reducing some power losses; the capital cost increase for such a pre-cooling spray arrangement would be much lower than the hybrid tower or the split steam system.

Dr. Maulbetsch concluded that water saving cooling technologies are feasible, but their costs are generally higher than conventional wet cooling technology, due to higher capital costs and some operating penalties of lowered capacity or efficiency. But adding a small amount of water to dry cooling systems can reduce those inefficiencies with only small capital cost increases.

Commissioner Laurie noted that the farther away from the coast you get the hotter it is, but less water is available, so he asked about research into increasing the efficiencies of dry cooling. It was stated that heat exchanger surfaces and manufacturing techniques are being studied and Mr. O'Hagan mentioned that staff is proposing research through EPRI under the PIER program to evaluate the spray enhancement for dry cooling facilities that was described previously.

Mr. Mike DiFilippo, Consultant for the Energy Commission on the PIER Program

Mr. Mike DiFilippo made a presentation describing the use of wastewater in powerplant cooling. Mr. DiFilippo explained that a wet cooling system required some "blowdown" of water to reduce the salt concentrations in the cooling water. Makeup water is needed to replace the water lost through evaporation and to replace the blow-down. Water supplies with lower initial salt concentrations could be cycled through the cooling tower more (high cycles of concentration) and would have smaller amounts of blowdown to dispose of in evaporation ponds or salt concentrating systems.

In coastal plants using a wet cooling system there are typically about five to seven cycles of concentration. In these systems there is no need for higher cycles of concentration, because there is a receiving body of water for blowdown discharge. For inland plants the cycles of concentration must be increased, and blowdown volume minimized because discharge is either not possible or highly restricted.

Mr. DiFilippo stated that there is a variety of degraded water sources in California, including contaminated groundwater, brackish surface waters and brackish ground water, agricultural return water, and reclaimed municipal effluent in large quantities. These waters typically contain common minerals, reclaimed water constituents (such as BOD, ammonia, and phosphate), hazardous contaminants (such as heavy metals, volatile organics, and pesticides), and other chemicals, such as perchlorate, nitrate, sulfide, and fluoride.

To avoid hazards and maintain equipment, these degraded waters need to be treated before use, generally with commercially available technologies, which could include softening, adjusting pH, reducing silica, and removing total dissolved solids. These treatments cost money and use chemicals, and in some cases, power. Sometimes side-stream treatment is needed because of the constituents of the cooling water source. Blowdown may also need to be treated to reduce or eliminate its volume (to zero discharge).

With higher concentrations of some cooling water constituents, different, more costly condenser metallurgies (such as copper-nickel or even titanium rather than brass) may be needed to control corrosion. Also, there are specialty chemicals that may need to be

added to the tower to help prevent scale formation, biological formation, and sedimentation from occurring in low flow areas of the system.

Mr. DiFilippo then discussed blowdown post-treatment disposal options. These include large evaporation ponds, brine concentrators with smaller evaporation ponds, and brine concentrators with crystallizers. Evaporation ponds as large as 200 acres have been built, so they need a lot of flat land (63 acres in the desert would be needed for the 500 megawatt combined cycle model plant) and they collect salt over time – they only make sense in hot and dry climates. Brine evaporators can reduce the disposal volume (and evaporation pond acreage requirement) by about 90% and produce high quality distillate water, at a cost of about one megawatt for the 500 megawatt model plant. Adding a crystallizer would eliminate the remaining liquid waste, producing solid salt crystals, at an additional energy cost of about 0.2 megawatts for the 500 megawatt model plant.

In response to questions by Ms. Townsend-Smith, it was explained that no currently operating power plants in California employ crystallizers, but others are in operation elsewhere in the country, and several are proposed for new power plants in California, including the approved High Desert and La Paloma projects.

Mr. DiFilippo then briefly presented some capital costs for the model 500 megawatt plant in the Central Valley and in the desert:

- Evaporation pond only ($32.9 and $22.1 million, respectively)
- Evaporation pond and evaporator ($6.7 and $5.6 million, respectively)
- Evaporation pond, evaporator, and crystallizer ($5.7 million in either location).

Commissioner Laurie then asked about the availability of degraded water for power plants, and Mr. DiFilippo stated that some salty waters are available in the Central Valley, but that he didn't know about availability in the desert.

PANEL 3: WATER POLICY

Mr. Michael Jackson, Water Attorney, Regional Council of Rural Counties

Mr. Michael Jackson stated that the Council's view is that there is ample water for the siting of power plants in the mountains, the foothills, and the Sacramento Valley, but probably not in the Delta itself or in the San Joaquin Valley, due to the characteristics of the state's water distribution system. He recommended not using potable water elsewhere, where alternatives are available. He also registered his concerns about evaporation ponds. He discussed problems at Kesterson Wildlife Refuge in the San Joaquin Valley where birds have been put at risk due to exposure to contaminated water. He also expressed support for use of the crystallizer technology to avoid evaporation ponds.

In reply to an inquiry from Commissioner Laurie, two projects in the Tulare Basin were identified as having evaporation ponds (Elk Hills and Midway-Sunset). Mr. Jackson

registered his concerns about salt buildup in the soils there, and, in general, about transfers of water from environmental and agricultural uses where water is in short supply.

Commissioner Laurie expressed his interest in the relationship between rural counties and smaller power plants and concerns about opposition to sites in the mountain or foothill areas. Mr. Jackson replied that possible sites exist – such as abandoned timber and industrial sites that would have abundant water and be near to transmission lines and gas pipelines in some places.

Gerald H. Meral, PhD, Planning and Conservation League (PCL)

Dr. Gerald H. Meral expressed his concern regarding the tightness of water supplies, particularly during drought situations, when there would be less hydro-power available – this is why there is all the more reason to try to the utmost to prevent dedication of fresh water resources to new power plants. He encouraged the Commission to become involved in attempts to find additional subsidies for the use of reclaimed water such as Proposition 13 provided and to urge increased water bond funding in the area of recycled water. He pointed out that it is very hard for the Commission to turn down a power plant because it's using fresh water, if there are no alternatives.

Commissioner Laurie noted that there's no Energy Commission policy dealing with the mandatory use of dry cooling or alternative systems. It is only addressed if upon environmental review it is found that water service is significantly impacted. And more often than not the data reflects the views of the local water districts, that there's an adequate supply of water to serve that project. Dr. Meral then referenced a PCL suit against DWR in which the reliability of delivery (versus a paper commitment) is a key issue.

Dr. Meral noted that there are so many demands for water (environmental demands, industrial, agricultural, etc.) that the Commission should try to develop generation technologies that need little or no water, or require generators to use a reclaimed water source.

Commissioner Laurie ask Dr. Meral about water designated by DWR for environmental uses (i.e., 45 percent of the state supply), and Dr. Meral replied that much of this water is in locations, such as the north coast, that are not the right places for power plant development.

MS. Kaitilin Gaffney, Center for Marine Conservation.

Ms. Kaitilin Gaffney explained that the Center for Marine Conservation is a national environmental organization dedicated to ocean protection. She is speaking up because of concern that we may be shifting siting towards the coast, since we don't have the same water supply issues there. She asked the Commission to look towards alternatives that do not require large volumes of fresh water, estuarine water, or ocean water.

Ms. Gaffney indicted that we need to be looking at dry cooling in all environments, because there is strong evidence that power plants, even those that draw from offshore

coastal waters, have very severe impacts on the environment. In response to a question from Commissioner Laurie related to those impacts, she stated that 70 trillion gallons of water go through powerplants every year in this country, mostly coastal waters. These waters contain fish, fish eggs, fish larvae, invertebrate eggs, and invertebrate larvae. She went on to cite fish entrainment and adverse kelp habitat impacts of the San Onofre plant. She stated that reducing or eliminating that volume would have a very immediate and direct benefit on those coastal ecosystems, which are facing increasing pressures from land-based pollution, from over-fishing, and from a variety of different human sources.

Commissioner Laurie then asked about ability to mitigate power plant impacts. Ms. Gaffney said that although we have newer technologies today and the volume of water per unit of energy has dropped because of increases in efficiency, use of 800 million gallons of water a day still causes a great impact – and energy demand is growing. Dr. Meral added that a mitigation lawsuit settlement for San Onofre was in the tens of millions of dollars and much of the mitigation money ended up being spent in San Diego County - they had to go that far south to find places to do the mitigation. He also mentioned that the Huntington Beach power plant intake might have been a factor in the recent near shore contamination episode there, by drawing in offshore sewage outfall discharges.

Ms. Gaffney went on to emphasize the difficulty of projecting impacts of coastal plants, other community concerns, the need for reducing water throughput, and advantages of siting plants closer to growing demand. Commissioner Laurie noted that people are moving inland, making for interesting energy planning. Ms. Gaffney then stressed the need to look at dry cooling, citing its use at 600 plants around the world.

ANSWERS TO THE QUESTIONS RAISED IN THE COMMITTEE'S WORKSHOP NOTICE

Issue 1: What is the Status of California Water Supply?

1. *What are the long-term projections for the availability of fresh inland water (including surface water and groundwater) for industrial uses? What prices are anticipated for these sources of water?*

   Mr. Kamyar Guivetchi, representing that the State Department of Water Resources provided a detailed breakdown of water supply issue in California. The following is from Mr. Guivetchs visual presentation:

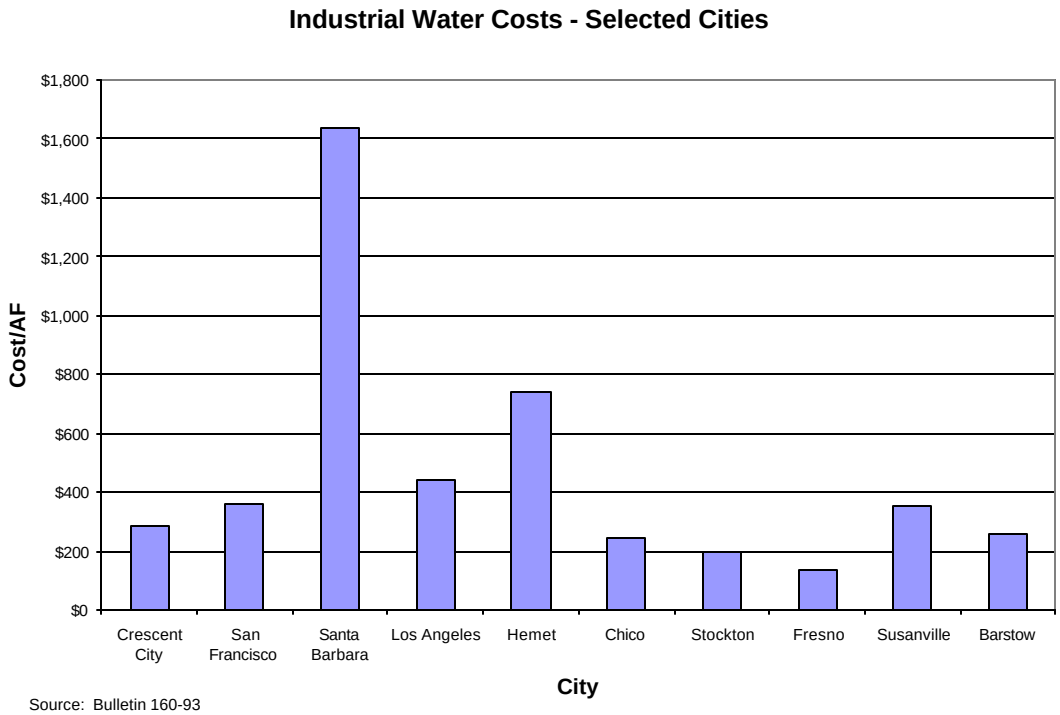
California Water Budget
with Existing Facilities and Programs

	(million acre-feet) 1995	2020
Water Use		
Urban	8.8	12.0
Agricultural	33.8	31.5
Environmental	36.9	37.0
Total	79.5	80.5
Supplies		
Surface Water	65.1	65.0
Groundwater	12.5	12.7
Recycled and Desalted	0.3	0.4
Total	77.9	78.1
Shortage	1.6	2.4

Source: Bulletin 160-98

Mr. Guivetchi also discussed methods to reduce demand and increase supplies, which would reduce the shortage indented above, which would reduce the shortage in 2020 to 0.2 million acre-feet. An electronic copy of Mr. Guivetchi's visual presentation can be found at www.energy.ca.gov/siting/constraints/documents/2001-02-08_presentations/

Water costs for industrial cities are shown below:



Source: Bulletin 160-93

Mr. Guivetchi also provide estimates for groundwater costs, which range from $130 per acre-foot in San Francisco Bay area to $10 per acre-foot in the North Coast area.

2. *How should the Commission apply State Water Resources Control Board Resolution 75-58 in siting cases? Should Resolution 75-58 be clarified or should new policies be developed to guide the continued use or new use of fresh inland waters for industrial purposes?*

Currently, staff has applied State Water Resources Control Board Resolution 75-58 to mean that an analysis of cooling alternatives should be considered in staff's analysis. However, since the cost of alternatives is generally higher than that of a wet cooling tower using fresh inland water, staff's analyses have only shown that the alternatives are preferred in those instances where their use would eliminate or lessen an environmental impact. Availability of water in California is a critical issue for development in many sectors of the economy, not just the powerplant generation sector. Although there are a number of methods to expanded the supply of water, ultimately there availability/cost will constrain development in California. Many of the panel member expressed concern over the use of water for powerplant cooling, noting that powerplants could be cooled with technologies that would reduce or for all practicable purposes eliminate the use of fresh in-land water. The current application of the SWRCB Resolution 75-58 could be refined to reflect the broader policy issues identified by the panel members.

3. *What alternatives exist for the use of fresh inland water for cooling?*
   a. *What are the environmental consequences of once-through cooling?*
   b. *What is the availability of recycled wastewater?*
   c. *What are the energy and environmental consequences of dry cooling or hybrid wet/dry cooling systems?*

Dr. John Maulbetsch and Mr. Mike DiFilippo provide a discussion of the cooling alternatives in California. Those include once-through cooling (primarily at coastal sites), wet cooling towers using fresh inland waters, and hybrid wet/dry cooling towers, either wet or wet/dry cooling tower using reclaimed water and dry cooling towers. Once-through cooling can have significant impacts on aquatic biological species due to thermal impacts, impingement and entrainment. Ms. Kaitilin Gaffney, representing the Center for Marine Conservation, provided an overview of possible impacts (see page 11). Mr. DiFilippo discussed possible sources of wastewater, including contaminated groundwater, brackish surface water, brackish groundwater, agriculture return water, reclaimed municipal effluent, and industrial process water or watewater. Mr. DiFilippo did not provide an estimate of the total amount of

wastewater available in California. The energy and environmental consequences or dry and hybrid wet/dry cooling systems were discussed by Dr. Maulbetsch. Dr. Maulbetsch explained that with dry cooling, steam is ducted to an air-cooled condenser, which is like an auto radiator. There would only be the 5% percent hotel and auxiliary load to consume water, with no blowdown, no drift, and no plume. It can be noisier than a wet cooling tower because a lot more air is circulated. The capital costs of an optimized dry cooling system should be between 1.5 and 2.5 times as much as an optimized wet cooling tower system, based on about ten different studies that have been conducted over the years. Additional information on cooling systems and wastewater can be found in Mr. Difilippo's and Dr. Maulbetsch's visual presentations, that can be found at: www.energy.ca.gov/siting/constraints/documents/2001-02-08_presentations/

4. *What criteria should the Energy Commission use to evaluate alternatives to the use of fresh inland water for power plant cooling? Are there circumstances in which the Energy Commission should require the use of such alternatives?*

The staff's application of SWRCB Resolution 75-58 results in evaluation of alternative cooling technologies and wastewater sources. As currently applied by staff, this evaluation would only result in requiring an alternative cooling technology, if the staff found that the project would result in significant environmental impacts that could not be mitigated through other means. Staff has generally found the use of available wastewater superior to use of fresh inland water. Some of the panel member suggested a more encompassing evaluation that would consider the social costs and benefits of use of alternative cooling technologies or water sources.

Issue 2: What water supply and water quality constraints exist for siting new powerplants?

1. *How should the Energy Commission evaluate alternative cooling options?*
   a. *What criteria should the Energy Commission use to evaluate alternative cooling options?*
   b. *Are there circumstances in which the Energy Commission should require the use of a specific cooling technology?*

Discussions during the workshop did not provide specific recommendations on how the Energy Commission should evaluate alternative cooling options. One method would be to continue staff's application of SWRCB Resolution 75-58. However, there was some discussion that staff' evaluation is not broad enough to consider the social implications of use of fresh inland water for powerplant cooling. Another method would be to expand staff's application to consider the

social implications. Still another method could be to require the use of a hybrid wet/dry or dry cooling system, unless an applicant could demonstrate that need to ensure the electric system reliability and serve load by siting a powerplant at a specific location, are not economic feasible using a hybrid wet/dry or dry cooling system.

2. *What information is required for coastal projects using once-through cooling?*

   a. *Should coastal repowering projects be treated as new projects or existing projects?*

   b. *How can the data gathering be expedited?*

   c. *What criteria should the Energy Commission use to evaluate alternative cooling technologies? Are there circumstances in which the Energy Commission should prohibit the use of once-through cooling?*

   d. *What is the best way to coordinate the requirements of the State Water Resources Control Board's Thermal Plan and Ocean Plan with the Energy Commission's siting process?*

   Again, these questions were not address in great detail by the workshop panel members. There was disagreement on whether coastal repowering project should be treated as new or existing projects, which would determine what requirements these systems would need to met. This issue may be addressed by pending federal rulemaking. Methods to expedite data gathering were also addressed at the workshop on Timing of Federal Permits. It is clear that the Energy Commission should provide clear early guidance to project developers on what information is necessary to approve once-through cooling systems. Staff should also evaluate alternative cooling technologies, including wastewater cooling systems, hybrid wet/dry and dry cooling systems as part of its evaluation of feasible methods to lessen or eliminate impacts on aquatic biological resources. Staff should continue working with local, state and federal agencies to ensure that their policies are addressed in the siting process.

3. *How should the Energy Commission evaluate local water issues?*

   a. *How should the Energy Commission evaluate well interference, the cumulative impacts caused by the project's contribution to reductions in flow and/or lowering of the water table, and impacts caused by pumping in a contaminated aquifer?*

   b. *What criteria should the Energy Commission use to evaluate the feasibility of alternative water supplies and alternative cooling methods? Are there circumstances in which local water issues should result in the Energy Commission requiring the use of an alternative water supply or an alternative cooling method?*

These questions whether not addressed in great detail during the workshops. Many of the panel members supported staff's approach to evaluating local water issues, and its evaluation of alternative cooling technologies and water sources. Still other panel members advocated a more rigorous consideration of the water policy issue raised by the use of fresh inland water for powerplant cooling.

STAFF RECOMMENDATIONS BASED ON WORKSHOP DISCUSSIONS

The supply of water in California is critical for development in every sector of the economy. Although there are a number of sources from which water supply can be expanded, ultimately there is a limited supply of water in California. It is in the states interest to estimate the need for water in the state from all sectors and to evaluate options for expanding the supply of water, and to evaluate alternatives to the use of fresh inland water, including ground water. Staff recommends that the Energy Commission consider the following to ensure that an adequate supply of water is available for powerplant cooling in the state.

A. The Energy Commission staff should provide DWR with estimates of the existing and future needs for water for powerplant cooling, to facilitate DWR's water resource planning efforts.

B. The Energy Commission staff should work with DWR and the State Water Resources Control Board (SWRCB) to identify potential sources of water for powerplant cooling. These sources should include wastewater and fresh water (including ground water). Staff, DWR and SWRCB should also identify areas in the state where powerplant development using fresh water should be discouraged, due to critical under supply of fresh water or due to expected future growth in other sectors of the economy.

C. The Energy Commission staff should work with the Coastal Commission, Regional Water Quality Control Boards and State Water Resources Control Board to identify potential future locations for coastal repowering powerplant development, to identify issues that must be addressed before approving that development, and to identify the information that powerplant developers will need to obtain to expedite licensing of these repowering powerplants.

D. Staff recommends that the Energy Commission develop and implement a policy that requires new generation to maximize water conservation measures for power plant cooling. SWRCB Resolution 75-58 requires the evaluation of alternative water supplies and/or cooling technologies. This policy, however, merely mandates the consideration of alternatives and does not prohibit the use of freshwater for cooling, even if such alternatives are readily available. Therefore, staff believes that this policy does not adequately address the true costs of using fresh or even potable water for power plant cooling in California. In light of California's looming water supply crisis, the use of fresh or even potable water for power plant cooling poses issues that are ignored by the economic or California Environmental Quality Act (CEQA) criteria used by staff in past siting cases to determine the suitability of using alternative sources of

cooling water or alternative cooling technology. For example, due to the greater capital cost and efficiency penalty associated with dry cooling, the reliance on economic criteria will almost always favor wet cooling and ignores long term reliability concerns as well as issues of protection of a limited resources.

The greatest emphasis in such a policy should be given to the use of dry cooling because, although more expensive, dry cooling significantly reduces facilities' water demand, removes a major siting constraint and ensures facility reliability during emergencies and droughts.

Emphasis should also be on using alternative sources of cooling water-such as wastewater, brackish groundwater, etc. These sources provide many of the same benefits of using dry cooling, although information requirements to properly evaluate such alternatives may delay the siting process. Finally, the policy should require whenever the use of fresh water is unavoidable, the maximum utilization of this resource. Projects using freshwater should be required to cycle this water 20 times or more and utilize zero discharge. This way the maximum use of the resource is achieved without raising water quality issues from wastewater discharge.